

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WATER WELL

(No.)

CODE 642

DEFINITION

A hole drilled, dug, driven, bored, jetted or otherwise constructed to an aquifer.

PURPOSE

- Provide water for livestock, wildlife, irrigation, human, and other uses.
- Provide for general water needs of farming/ranching operations.
- Facilitate proper use of vegetation on rangeland, pastures, and wildlife areas.

CONDITION WHERE PRACTICE APPLIES

This practice applies on all land uses where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This practice applies only to production wells. Specifically excluded are any types of wells installed solely for monitoring or observation purposes, injection wells, and piezometers. The standard does not apply to pumps installed in wells; above ground installations, such as pumping plants, pipelines, and tanks; temporary test wells; and decommissioning of wells (ASTM D 5299).

CRITERIA

Water wells will be drilled and installed in accordance with the rules of the Tennessee Department of Environment and Conservation, Division of Water Supply, Chapter 1200-4-9, "Water Well Licensing Regulations and Well Construction Standards," and the Water Well Act (T.C.A. 69-11-101 (et seq.)).

Suitability of Site. The availability of ground water for its intended use at the site will be determined by using reliable local experience and reviewing all available relevant geologic maps and reports; well records maintained by State and Federal agencies; and design, construction, and maintenance records of nearby wells. An appropriate level of investigation, including test well drilling, is conducted on-site, as needed, prior to well construction to determine site-specific hydrogeologic conditions. The source of water for any well will be at least 19 feet below the surface of the ground unless approved by the Tennessee Department of Environment and Conservation, Division of Water Supply.

The site will be suitable for safe operation of the drilling equipment.

Well Head Protection. Wells will be located at safe distances from potential sources of pollution, including unsealed abandoned wells. The allowable distance will be based on consideration of site-specific hydrogeologic factors and will comply with requirements of all applicable State or local regulations or construction codes. No water well may be constructed at other than a safe distance from any known source of contamination. The minimum safe distances from some sources of contamination are listed in Table 1.

Surface runoff and drainage that might reach the wellhead from potential areas of contamination, such as those used by livestock, will be diverted. A water well may be constructed in an area subject to flooding provided the top of the watertight casing extends not less than 2 feet above the 100-year flood plain.

Table 1

SOURCES OF CONTAMINATION	MINIMUM DISTANCES
Animal Pens or Feed Lots	100 feet
Leaching Pits; Sewage Lagoons	200 feet
Pit Privies	75 feet
Sewer Lines	50 feet
Sludge and Septage Disposal Sites	100 feet
Septic Tanks and Drain Fields	50 feet
House to Septic Tank Connections, if Line is Tight	10 feet

Wells will be located a safe distance from both overhead and underground utility lines and other safety hazards.

Water wells will not be located closer than 10 feet from a property line. New wells from 10 to 25 feet of a property line will

require a minimum of 35 feet of casing installed below the land surface with impervious material such as cement grout or bentonite chips, tablets, or bentonite grout backfilled in the annular space to a depth of 35 feet.

All water wells will be located so that the center line of the well extended vertically will clear any projection from an adjacent building by not less than 5 feet.

Drilling Fluids: Drilling fluids and water used for construction of the water well will be in accordance with the rules of the Tennessee Department of Environment and Conservation, Division of Water Supply, Chapter 1200-4-9-10, "Water Well Licensing Regulations and Well Construction Standards."

Borehole. Drilled, jetted, bored, and driven wells will be sufficiently round, straight, and of adequate diameter to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.

Use of Casing. Casing will be installed to seal out undesirable surface or willow ground water and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic materials may not require casing.

Casing Diameter: Casing diameter will be sized to permit satisfactory installation and efficient operation of the pump and large enough to assure that uphole velocity is 5 feet per second or less to protect against excessive head loss.

Materials. Casings may be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete, or other material of equivalent strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing.

Steel well casings will meet or exceed requirements specified in ASTM A 589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A 589.

Only steel pipe casings will be used in driven wells.

To prevent galvanic corrosion, dissimilar metals will not be joined.

Plastic casings made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) will conform to material, dimensional, and quality requirements specified in ASTM F 480.

If the water is to be used for human consumption, plastic pipe will be approved by the National Sanitation Foundation.

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F 480.

Filament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints

will meet requirements specified in Section 3.8, ASTM F 480.

Fiberglass pressure pipe (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) will meet or exceed requirements specified in ASTM D 3517.

Casing Strength. Well casing wall thickness will be sufficient to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development, and use. Required casing strength will be determined as shown in NEH Part 631, Chapter 33, Investigations for Ground Water Resources Development.

Joint Strength. Joints for well casings will have adequate strength to carry the load due to the casing length and still be watertight, or will be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings will terminate on firm material that can adequately support the casing weight.

Screen. Well screens will be installed in any aquifer material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections.

The screen will be constructed with the slot width determined from aquifer samples (Part 631, National Engineering Handbook (NEH), Chapter 33). Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met. Screen open areas can range from 1 percent for field-perforated screens to 25 percent or more for continuous wire-wrapped screens. To assure good well efficiency, open areas should be designed to approximate aquifer porosity. High open area percentages also make well development more effective. The

length and open area of the screen will be sized to limit entrance velocity of water into the well to less than or equal to 0.1 foot per second (Part 631, NEH, Chapter 33, Example 33-2).

Depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well will govern the position of the screen in the well.

Maximum drawdown will not be permitted below the top of the highest screen or pump intake.

Seals (Packers). Telescoped screen assemblies will be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.

Filter Pack. Installation of a filter pack around the well screen will be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer, such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; a requirement for maximum yield from a low-yielding aquifer; and holes drilled by reverse circulation.

Pre-packed Well Screens. For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial pre-packed well screen may be substituted for a conventionally installed (by tremie) filter pack.

Installation. Casing will extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.

All wells will be cased to a sufficient height (minimum of 12 inches) above the ground

surface to prevent entry of surface and near-surface water.

Casing for artesian aquifers will be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.

If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone will be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

Well Development. Well development will be performed to repair damage done to the formation by the drilling process, and to alter the physical characteristics of the aquifer surrounding the borehole so that water will flow more freely to the well.

The method of well development used will be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

Aquifer Development. For massive, unfractured rock that is unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation.

Grouting and Sealing. The annulus surrounding the permanent well casing at the upper terminus of the well will be filled with mortar containing expansive hydraulic cement (ASTM C 845), or bentonite-based grout. The length of the grout seal will be no less than 10 feet and not less than the minimum specified in State or locally applicable construction codes.

If the water is intended for human consumption, the casing will be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions.

A positive seal (grouted in place) or packer will be provided between the casing and the less pervious material overlying the aquifer of artesian wells and in all aquifers where co-mingling of waters is undesirable.

Access Port. An access port with a minimum diameter of 0.5 inch will be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover will be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

Disinfection. Wells will be disinfected immediately with a chlorine solution following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction. A chlorine solution will be placed in the well in sufficient dosage to produce a chlorine residual of at least one hundred parts per million (ppm) in the water standing in the well. The well casing, pump column, and any other equipment above the water level in the well will be thoroughly rinsed with the chlorine solution as part of the disinfecting process. The chlorine treated water will stand in the well for a period not less than 12 hours. The well will be pumped after the minimum 12-hour period until the odor of chlorine is no longer detectable.

Water Quality Testing. Sampling and testing will comply with all applicable Federal, State, and local requirements. These requirements vary according to the water quality parameters associated with the intended use(s) of the water.

CONSIDERATIONS

The potential for adverse interference with existing nearby production wells will be evaluated in planning.

The potential for ground water overdraft and the long-term safe yield of the aquifer will be considered in planning.

If practicable, wells will be located in higher ground and up gradient from sources of surface contamination or flooding. In determining gradient, both pumped and unpumped conditions will be considered.

Potential effects of installation and operation of the well on cultural, historical, archaeological, or scientific resources at or near the site will be considered in planning.

PLANS AND SPECIFICATIONS

Plans and specifications will be prepared for specific field sites in accordance with this standard and will describe the requirements for applying the practice to achieve its intended uses.

OPERATION AND MAINTENANCE

A plan for maintenance of a well will be prepared. The well construction records will be kept on file with the maintenance plan by the owner/operator. As a minimum, the plan will include a statement of identified problems, corrective action taken, date, and specific capacity (yield per unit drawdown)

of well before and after corrective action was taken.

either the unit name as determined in the literature or dominant lithology present use to describe the material.

DOCUMENTATION REQUIREMENTS

1. Documentation requirements are contained in the Rules of the Tennessee Department of Environment and Conservation, Division of Water Supply, Chapter 1200-4-9, "Water Well Licensing Regulations and Well Construction Standards."
2. Soil materials will be described in accordance with ASTM D 2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)."
3. Bedrock will be described in accordance to standard geologic terminology with

REFERENCES

National Engineering Handbook, Part 631, Chapter 33, *Investigations for Ground Water Resources Development*.

Tennessee Department of Environment and Conservation, Division of Water Supply, Chapter 1200-4-9, Water Well Licensing Regulations and Well Construction Standards.

Tennessee Code Annotated, Water Well Construction Act (T.C.A. 69-11-101 (et seq.)).